TRANSISTORIZED POWER & BIAS SUPPLY

MODEL

1020

INSTRUCTION

MANUAL

1020-2

ELECTRONIC INSTRUMENT CO. INC.
3300 NORTHERN BLVD., L. I. CITY 1, N. Y.

GENERAL DESCRIPTION

The EICO Model 1020 is a transistorized d-c power and bias supply. The output, monitored by a dual range voltmeter (0-6 volts and 0-30 volts) is continuously variable from 0 to 30 volts. The maximum ripple under any possible voltage or current condition, is only 1/200 of 1%. The permissible load current is 150 ma when operating the unit from 0-12 volts, 200 ma when operation is from 12 to 24 volts and 300 ma when operation is from 24 to 30 volts. Two type 2N256 power transistors and a rugged power transformer are used to permit safe and reliable operation over the complete functional range of the instrument. A fuse, accessible from the front panel, protects the unit against shorts and overload. The power supply is housed in a rugged, grey wrinkle, steel case.

FEATURES AND APPLICATIONS

The extremely low ripple and wide voltage range permits the use of this instrument in a wide variety of applications.

The technician can use the 1020 power supply during the servicing of transistor radios, hearing aids and preamplifiers. Any unit, drawing no more than the currents recommended above, transistorized or otherwise, may be used with this power supply. It can also be used in television and radio servicing work, to offset the AVC and AGC voltages during alignment. In color TV adjustments, the EICO Model 1020 power supply can be used to cut off the color burst amplifier. DC filament supply voltages can be taken from this unit if the current ratings of the 1020 are not exceeded.

In the laboratory, the EICO Model 1020 has innumerable applications. It can be used advantageously in design of transistor radios, tuners, and preamplifiers. The low ripple characteristics will permit the engineer to use this unit as a variable bias supply in the development of transistor or vacuum tube circuits. The application as a filament bias supply is obvious. It also permits the checking of the current and voltage characteristics of high resistance relays.

SPECIFICATIONS

Voltage Range: 0-30V, continuously variable

Voltmeter Ranges: 0-6V, 0-30V. Ranges selected by slide switch.

Maximum Current Capacity:
Voltage Output: 0-12V, Max. current: 150 ma
Voltage Output: 12-24V, Max. current: 200 ma
Voltage Output: 24-30V, Max. current: 300 ma

Ripple: Full load - 1/200 of 1% - 120 cycles

Fuse: 1/2 Amp slow flow in DC circuit

Power Line Requirements: 110-120 volts, 50/60 cps AC

Power Consumption: 20 watts

Size (HWD): 5" x 4" x 5 1/2"

Shipping Weight: 4 1/2 lbs.

CIRCUIT DESCRIPTION

The power supply is essentially a full wave circuit. Two transistors in series, connected in grounded collector circuitry, maintain the ripple at a negligible level.

In the primary circuit of the transformer, the switch (physically on the rear of the dual pot, voltage output control) turns the power supply as well as the neon bulb indicator on and off. There is no fuse in this circuit. Thus, the fuse protecting the transistors and DC circuitry may be blown while the neon bulb remains lit.

The center tapped secondary is converted to DC by employing the full wave rectifier circuit, using two silicon diodes. The cathode side of these diodes is positive (+) while the center tap of the transformer, going through the fuse, is the negative (-) side. A 500 ufd filter condenser smooths out the ripple.

Two PNP transistors are connected in series, so that the full voltage from the diode circuit may be applied across the two units. They are connected in a grounded collector circuit — not unlike the cathode follower circuit in vacuum tubes.

The collector-base voltage for each transistor is controlled by the dual potentiometer. This voltage will affect the emitter current, which will in turn determine the output voltage. The transistors are operated at the saturation region of the curve, so that small voltage variations in the collector circuit will not result in current variation in the emitter circuit. These small variations may be ripple voltages at the transistor input, which are thus not transformed into ripple current at the transistor or power supply output. This results in an extremely good ripple factor.

Any ripple that may get through, is further reduced by the 50 ufd capacitor across the output terminals of the EICO Model 1020. Do not add more capacity here, or elsewhere, as optimum values have been selected.

A meter monitors the output voltage. When the 1.5K resistor, in series with the meter movement is shorted out, the meter reads 6 volts full scale. When the resistor is in the circuit, the reading is 30 volts full scale.

One further circuit refinement is the location of the fuse. In its location, it is the most direct method in preventing any continuous current overload of the transistors. If it were in the primary, its action would not be as exact, due to transformer resistive and core losses. In the

COPYRIGHT© 1959 ELECTRONIC INSTRUMENT COMPANY, Inc.

primary circuit the ratio of the short circuit current to the working current is not as high as in the secondary circuit.

FUNCTION OF CONTROLS & TERMINALS

The two jacks at the lower, right hand corner of the panel are for voltage output. The polarities are as marked. The negative (-) terminal is also chassis ground. The positive (+) terminal should, therefore, never be shorted to the chassis or panel.

The VOLTAGE ADJUST control regulates the amount of voltage across the output terminals. As the control is advanced in the clockwise direction, the voltage across the terminal jacks is increased. In the maximum counter-clockwise position, the unit is turned "OFF" when the click of the switch on the control is heard.

The slide switch at the left determines the voltage range of the meter. When the slide is advanced upward, the full range meter reading is 6 volts. With the slide switch in the "down" position, the full range meter reading is 30 volts. Do not switch from the 30 volt to the 6 volt position unless the meter reads less than 6 volts on the 30 volt scale.

The fuse is a 1/2 amp, slow blow type. When replacing this fuse, use only the exact replacement, as marked on the fuse.

The indicator bulb, below the meter, can be on, whether or not the fuse is blown. It indicates if your power supply is switched on or off.

OPERATION

The first step is to determine the voltage you will need. Next, find the current drawn by the unit to be powered by your 1020. If you need 0 to 12 volts, do not use loads requiring more than 150 ma from your 1020. If you need 12 to 24 volts, do not use loads requiring more than 200 ma from your 1020. If you need 24 to 30 volts, do not use loads requiring more than 300 ma from your 1020. The actual current drawn can be determined by inserting a milliameter in series with the unit connected to the power supply.

After you have decided upon the voltage you need, and have determined that the current drain is within the specifications of your EICO Model 1020 power supply, set the meter range selector to the desired position. If you require less than 6 volts, put the slide switch in the 6V position and read the voltage on the black meter scale. If you require from 6 to 30 volts, put the slide switch in the 30V position and read the voltages on the red meter scale. Never switch from the 30 volt range to the 6 volt range unless the meter reads less than 6 volts on the 30 volt scale.

Next, connect the load (radio, hearing aid, etc.) across the output terminals. Note the polarity required for the load. Reversing the polarity may ruin the Model 1020 power supply, as well as the item you have connected to it. When the load you are using has no specific polarity requirements, such as a relay, it may be connected in either direction.

You are now ready to apply voltage. Set the range switch in the proper position, as described above, with the load connected. Turn the voltage adjust knob up slowly, until the meter reads the voltage you require.

A milliameter, in series with the load is useful. If when increasing the voltage, you find the milliameter reads more than expected, DO NOT increase the voltage any further until you have discovered the trouble with the item under test.

After using the instrument, turn the Model 1020 off by turning the voltage adjust knob to the maximum counter-clockwise position, until a click is heard and the light from the indicating bulb under the meter movement is extinguished.

APPLICATIONS

1. Transistor radios usually run on batteries. For use at home, when AC power is available, it is wasteful to power your radio by battery. Disconnect your battery from the radio and connect the terminals, previously connected to the battery, to the power supply.

It must be connected to the power supply with the same polarity as it was previously connected to the battery. The terminal which has been connected to the (+) on the battery is now to be connected to the (+) jack on the 1020 power supply. The remaining terminal is to be connected to the (-) jack on the 1020. Turn your voltage adjust control up until the rated battery voltage is reached.

2. For repair work, the EICO Model 1020 power supply can be substituted for a battery when current requirements are consistent with the current limitations of the 1020. This unit can be used to supply power for transistor radios, transistor hearing aids, transistorized preamplifiers, transistorized instruments, etc. In each case, adhere to the polarity and voltage of the battery ordinarily used with the item to be repaired. A milliameter, connected in series with the unit under repair is a necessity, to indicate current drain. If safeguards the item you are testing while indicating a possible overload of your power supply.

3. In aligning radios and television sets, it is frequently necessary to "kill" the AVC and AGC. A method for doing this, without upsetting the operation of the receiver, is to supply a low impedance voltage of average value across the AVC and AGC line. This is discussed in full

detail in "TV Sweep Alignment Techniques" by Art Liebscher on page 52 (Rider), in "How to use Signal and Sweep Generators" by J. R. Johnson on page 87 (Rider) and in Sweep and Marker Generators for TV and Radio" by R. G. Middleton on page 177 (Gernsback).

The Model 1020 power supply is extremely important in this application.

4. In color television sets, manufacturers recommend that the color killer be biased up to 30 volts during the alignment procedure. In this application, the EICO Model 1020 power supply is ideal. For exact procedure in each individual case, see the manufacturer's service manual.

5. The Model 1020 can be used as substitute bias supply, in designing vacuum tube or transistor circuits. Connected in the proper polarity to the transistor or vacuum tube element under test, vary the voltage until the optimum operating condition for the device in question is achieved.

6. Filament current canbe supplied by your Model 1020 power supply, in some applications. In any case, be certain that you do not exceed the current ratings of your Model 1020 as indicated in the specifications.

7. It is frequently possible to reduce the hum in a high fidelity preamplifier by biasing the filaments to a DC voltage above or below ground potential. To determine the best voltage for this application, remove any connection from the filament circuit to ground, in your preamplifier. Connect the (-) jack on your model 1020 to the chassis and the point in the filament circuit lifted off ground, to the (+) jack. Turn the voltage adjust knob, until minimum hum conditions are achieved.

Next reverse the connection to the power supply, connecting the chassis to the (+) jack on your 1020 and the (-) jack to the filament circuit, as above. Once again, turn the voltage adjust up, until the minimum hum condition is achieved. The lower minimum hum condition is the desired voltage and polarity to be applied to the heater circuit. It is frequently difficult to ascertain the optimum bias voltage due to only slight variations.

8. To check low current high resistance relays, connect the relay through a milliameter tothe power supply. These units are usually not polarized so they may be connected in either direction in the 1020. Turn the voltage up until the relay closes. The reading on the 1020 meter will indicate the voltage necessary to actuate the relay, while the milliameter will read the current at this voltage.

9. This unit can be used in small electroplating applications. Connect the negative (-) jack on your Model 1020 to the item to be plated, the cathode. Connect the positive (+) jack on your Model 1020 power supply, through a milliammeter, to the remaining anode terminal. Turn the voltage adjust control up until the milliameter shows a reading of 100 to 150 ma. The lower the current, the better the plating deposit, but the longer in time consumption. It may take several hours until the plating process is completed to your satisfaction. Refer to your chemistry text books for complete details as to plating solutions, materials and spacings.

MAINTENANCE

Your instrument should require very little servicing if the precautions as to overloading and polarity are observed scrupulously. To facilitate servicing, some possible troubles and their causes are listed in the TROUBLE-SHOOT- been wired correctly. VOLTAGE and RESISTANCE charts are also provided as an aid to locating defective components.

SERVICE

If trouble develops in your instrument which you can not remedy yourself, write to our service department listing all possible indications that might be helpful. If desired you may return the instrument to our factory where it will be placed in operating condition for $4.00 plus the cost of parts replaced due to their being damaged in the course of construction. NOTE: Before returning this unit, be sure all parts are securely mounted. Attach a tag to the instrument, giving your home address and the trouble with the unit. Pack very carefully in a rugged container, using sufficient packing material (cotton, shredded newspaper, or excelsior), to make the unit completely immovable within the container. The original shipping carton is satisfactory, providing the original inserts are used or sufficient packing material inserted to keep the instrument immovable. Ship by prepaid Railway Express, if possible, to Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, New York. Return shipment will be made by express collect. Note that a carrier cannot be held liable for damages in transit if packing IN HIS OPINION, is insufficient.

RESISTANCE CHART

TEST POINT	OHMS	COMMENT
TR1, TR2 body and all mounting screws	3-4K	If high, check wiring If low, check for shorts (partial) If zero, transistor body probably shorted to chassis; check mica washers for damage
XTR1-1 XTR1-2	2-4K	If not obtained, components or wiring in path defective
XTR2-1	2-3K	If not obtained, components or wiring in path defective.
XTR2-2	0	If not obtained, components or wiring in path defective
pos. ohmmeter lead to pos. lead of C2 neg. ohmmeter lead to neg. lead of C2	3K after one minute	Near or dead short indicates defective wiring or shorted slicon rectifier
J1	1-2K	Near or dead short indicates wiring error or shorted C5 capacitor

CONDITIONS OF MEASUREMENT: Voltage ADJUST knob turned to OFF. Model 1020 disconnect from AC line. Slide switch set to "30V" position. Both transistor sockets XTR1 and XTR2 removed from the transistor and left hanging free by their leads. Positive lead of ohmmeter always goes to given test point, and negative lead of ohmmeter to negative output terminal J2 (ground) unless specified otherwise. NOTE: After the resistance checks are completed, do not forget to replace sockets XTR1 and XTR2 on transistors TR1 and TR2 in the same orientations they had previously. See Fig. 1 below.

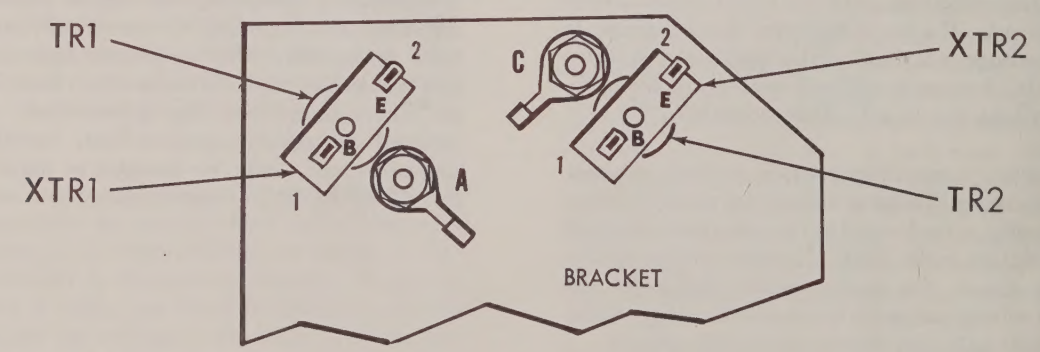


Fig. 1. Transistor socket lug identification & location of test points

GENERAL INSTRUCTIONS

The section of the manual beginning with this page is the CONSTRUCTION section. All pages in this section have page numbers followed by "C" (1C, 2C, etc.). The INSTRUCTION section resumes on the pages following the CONSTRUCTION section. Note that the CONSTRUCTION section is located centrally in the book and may be removed without disrupting the INSTRUCTION section that both precedes it and follows it.

Care taken in the construction of this instrument will reward the constructor with many years of satisfactory service and greater confidence in his instrument. We urge you to not rush the construction, but to take all the time necessary for proper assembly and wiring.

Furthermore, we urge strongly that you follow the wire and parts layout shown in the pictorial diagrams as closely as possible. Very often wires are placed as shown for a good reason, and certainly the appearance of the completed instrument will be improved and the difficulty of finding a wiring error will be reduced by the following the wire and parts layout shown.

UNPACKING THE KIT: Unpack the kit carefully and check each part against the parts list including those parts that are mounted to the chassis. If you have trouble identifying any parts refer to the pictorial diagrams or the color code chart. The color code of each component is printed each time the component is referred to in the book.

You will find that the value of a component will vary within the allowable circuit tolerance. For example, the 4.7KΩ, ±10% resistor may measure anywhere between 4.2KΩ and 5.2KΩ. Tolerances on paper capacitors are substantially greater, and the tolerance for electrolytics is usually +100% and -50%.

CONSTRUCTION HINTS: USE THE BEST GRADE OF ROSIN CORE SOLDER ONLY, preferably one containing the new activated fluxes such as Kester "Resin-Five", Ersin "Multicore" or similar types. UNDER NO CIRCUMSTANCES USE ACID CORE SOLDER OR ACID FLUX since acid flux can cause serious corrosion. Before soldering make certain of a good mechanical connection. Use a clean, freshly tinned soldering iron, no smaller than 100 watts, and place the solder on the joint (not on the iron) so that the solder is melted by the heat from the joint itself. Do not remove the soldering iron until the solder flows and check to see that the resulting joint is smooth and shiny when the solder has cooled. There are two extremes to be avoided; too little heat and too much heat. If too little heat is supplied, the joint will appear pitted and grey, indicating a rosin joint which is unsatisfactory. On the other hand, if too much heat is applied to a joint, the parts connected to it may either change value, loose their protective coating, or break down. If you are soldering close to a part, hold the lead between the part and the joint being soldered with the tip of a pair of longnose pliers. The pliers will conduct the heat away and prevent the component from being unduly overheated. If for any reason it is necessary to resolder a joint, be sure to use new solder.

It should also be noted that the leads on resistors, capacitors, and transformers are often longer than required. These leads should be trimmed to the proper lengths. The recommended lengths, as well as the required lengths of all wires, are indicated in the wiring steps.

BASIC TOOLS REQUIRED: These basic tools are required for the construction of the amplifier.

1. Screwdriver - 3/16" to 1/4" blade
2. Screwdriver - 1/8" blade
3. Longnose pliers - 5 or 6"
4. Diagonal cutters
5. Soldering iron (100 watts), or soldergun, or pencil iron (35 watts)
6. Gas pliers
7. High quality rosin or equivalent synthetic flux core solder. Do not use acid or paste flux under any circumstances.

A set of spintites and a wire stripper are also very useful supplementary tools.

PARTS IDENTIFICATION: Please note that many of the resistors and capacitors for which color coding is given, may not be color coded, but have their values and ratings printed. To aid in rapid identification 10% and 20% resistors are almost color coded, while all 1%, 5% resistors and all capacitors usually have their values printed. Printed numbers may appear with the letter "K", indicating that the number is to be multiplied by 1000. The letter "M" indicates a multiplication by 1,000,000. "mf" indicates microfarads or 1/1,000,000 farad. "mmf" indicates micromicrofarads or 1/1,000,000 of a microfarad. The alternate way of writing capacitor values are indicated in the construction book when the component is used. Please note the following examples of relationship between units.

1,000,000 micro-microfarads (mmf) = 1 microfarad (mf)
10,000 mmf = 10K mmf = .01 mf
1,000,000 ohms (Ω) = 1000 kilohms = 1 megohm (MΩ)
2,700,000Ω = 2,700KΩ = 2.7MΩ
470,000Ω = 470KΩ = 0.47MΩ
2,700Ω = 2.7KΩ

CONSTRUCTION PROCEDURE: The complete step-by-step mounting wiring procedure follows: To keep the drawings uncrowded, unnecessary repetition of mounting or wiring details may be omitted. Note: The abbreviation (C) means connect but do not solder (until other leads have been connected). The abbreviation (S) means connect and solder. The number after "(S)" indicates the number of connections to be soldered to the terminal. You can also check if you have made the proper number of connections to the terminal.
Bend the ground lug tabs on the sockets toward the chassis to prevent accidental shorting to the socket pins.

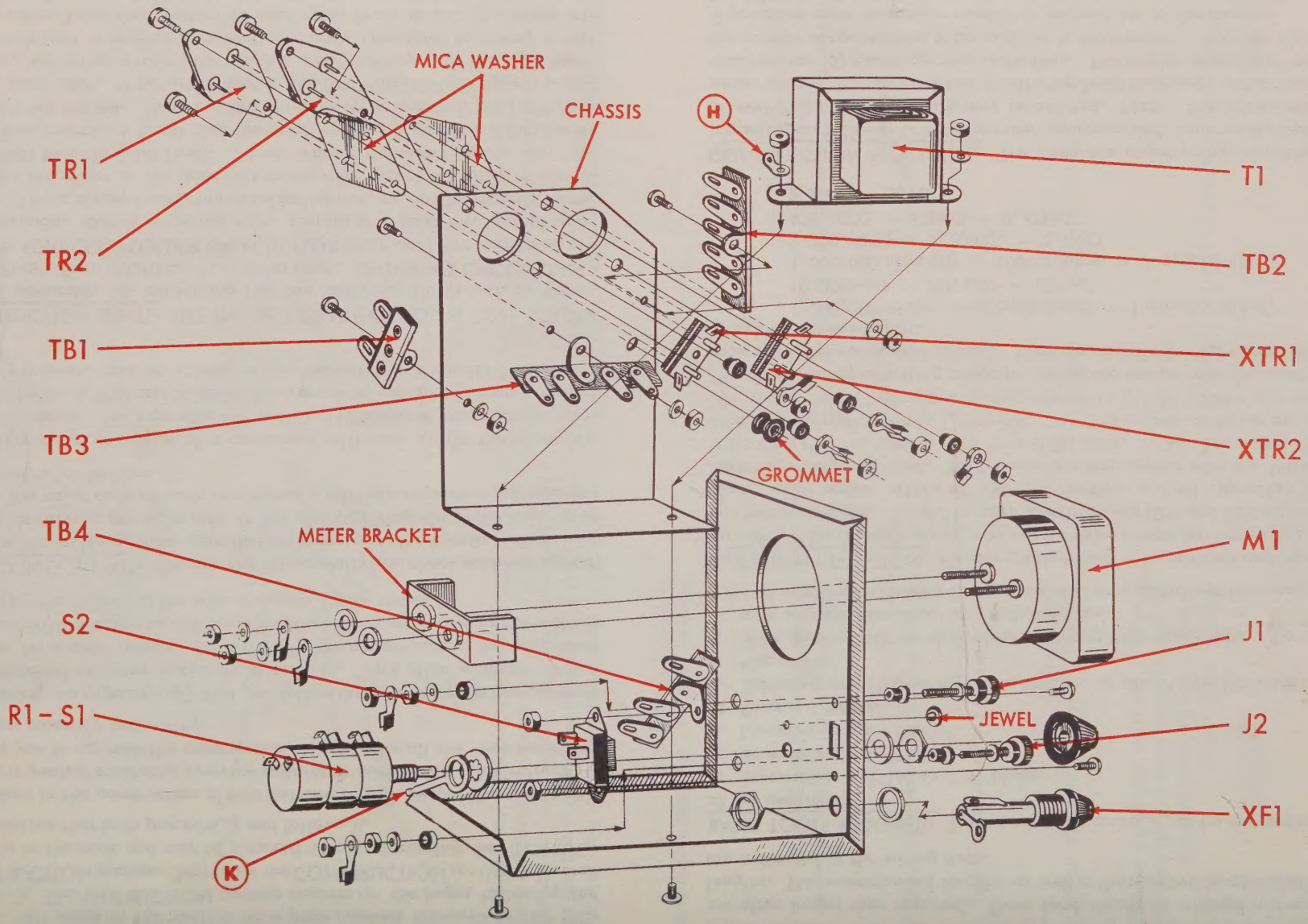

MICA WASHER
CHASSIS
H
TR1
TR2
T1
TB2
TB1
XTR1
TB3
XTR2
GROMMET
TB4
METER BRACKET
M1
S2
J1
R1 - S1
JEWEL
J2
XF1
K

Fig. 1

ASSEMBLY

1. ( ) Fig. 1. On the front panel, mount the slide switch S2, as shown. Note that the two lugs are mounted toward the top. Use two #4-40 screws and two #4-40 hex nuts. Under the upper mounting hole on the switch, between the switch and the chassis, mount a three post two left terminal strip, TB4.

2. ( ) Fig. 1. Mount the voltage output jacks J1 and J2, on the front panel, as shown. Each jack consists of one bakelite binding post, one flat bakelite washer about 1/8" thick, one shoulder type bakelite washer about 3/16" thick, one #8 flat washer, two #8-32 hex nuts and one #8 ground lug. J1 is to be a red jack and J2 is to be a black jack. From the front of the panel, mount the shoulder washer and through the hole of the shoulder washer, push the threaded portion of the binding post. From the rear of the panel, push the flat bakelite washer over the protruding section of the shoulder washer. Over the flat bakelite washer, place the thin flat metal washer. Secure all these components to the panel with one #8-32 hex nut. Over this nut, place the #8 ground lug. Secure this #8 ground lug with a second #8-32 hex nut. Note the direction for mounting each lug in figure 3.

3. ( ) Fig. 1. Mount fuse holder XF1 using the thin rubber washer from the front of the panel, as shown. Secure to panel with nut. Do not tighten too much or fuseholder will crack. (See Fig. 2). Insert 1/2 amp fuse in fuseholder.

4. ( ) Fig. 1. Mount dual pot with switch, R1A, R1B, S1, as shown. Use one 3/8 lockwasher, one 3/8 flatwasher and one 3/8 hex nut. Under the lockwasher, mount a pot grounding lug, K oriented as shown in figure 3.

5. ( ) Fig. 1. Mount the meter movement, M1, as shown. Mount the meter on the front of the panel. From the rear, place the bracket over the meter terminals. Note the insulators in the bracket so that the meter terminals will not be shorted. Over the insulators on each terminal, place a #10 flat washer, a #10 ground lug, a #10 lockwasher and a #10-32 hex nut. Note the proper orientation of the ground lugs in the figure. Orient the meter so that it is facing straight up and down with respect to the front of the panel.

6. ( ) Fig. 1. Push the pilot light jewel into the hole below the meter from the front of the panel.

7. ( ) Fig. 1. Turn the potentiometer R1A, R1B, S1 to its maximum counter-clockwise position, so that the switch clicks off. Secure the knob on the shaft so that the pointer faces the "OFF" marked on the panel.

8. ( ) Fig. 1. On power transformer T1, cut one black lead to 4" and the second black lead to 7". Cut all the remaining leads to 2 1/2". Strip back 1/4" of insulation from the ends of each lead. Mount the chassis and the power transformer to the bottom portion of the panel mount, through the two matching holes at the bottom of the chassis. The black leads of the transformer face away from the chassis bracket. Use two #6-32 x 3/8 screws and two #6-32 hex nuts. Under one hex nut, mount a #6 lockwasher. Under the second hex nut, mount a #6 ground lug "H".

9. ( ) Fig. 1. From the rear of the chassis, mount two post terminal strip TB1 and four post with ground terminal strip, TB2 (Fig. 3). From the front of the chassis, mount a four post terminal strip, TB3 (Fig. 2). Use one #6-32 x 1/4 screw, one #6 lockwasher and one #6-32 hex nut on each.

10. ( ) Fig. 1. Push a rubber grommet into the hole in the chassis next to TB3.

11. ( ) Fig. 1. Holding the unit as shown in the drawing, mount the two transistors, TR1 and TR2, as shown. Note that the two pin terminals on the transistor are not exactly midway between the two mounting holes. The two pin terminals are closer to one mounting hole than to the other. The transistors are mounted so that the mounting hole to which the pins are closer will be the upper one of the two. The transistors are mounted from behind the chassis. A thin piece of mica is placed between the chassis and each transistor. Handle these mica washers very carefully since they are brittle. Each transistor is secured to the chassis with two #6-32 x 3/8 screws and two #6-32 hex nuts. Since the screw must be insulated from the chassis, a fiber shoulder washer is used against the chassis. Between each fiber shoulder washer and the hex nut, mount #6 ground lug. Do not tighten screws too much or mica washer might crack.

12. ( ) Fig. 1. Over the pin terminals on each transistor, place a transistor socket XTR1 and XTR2.

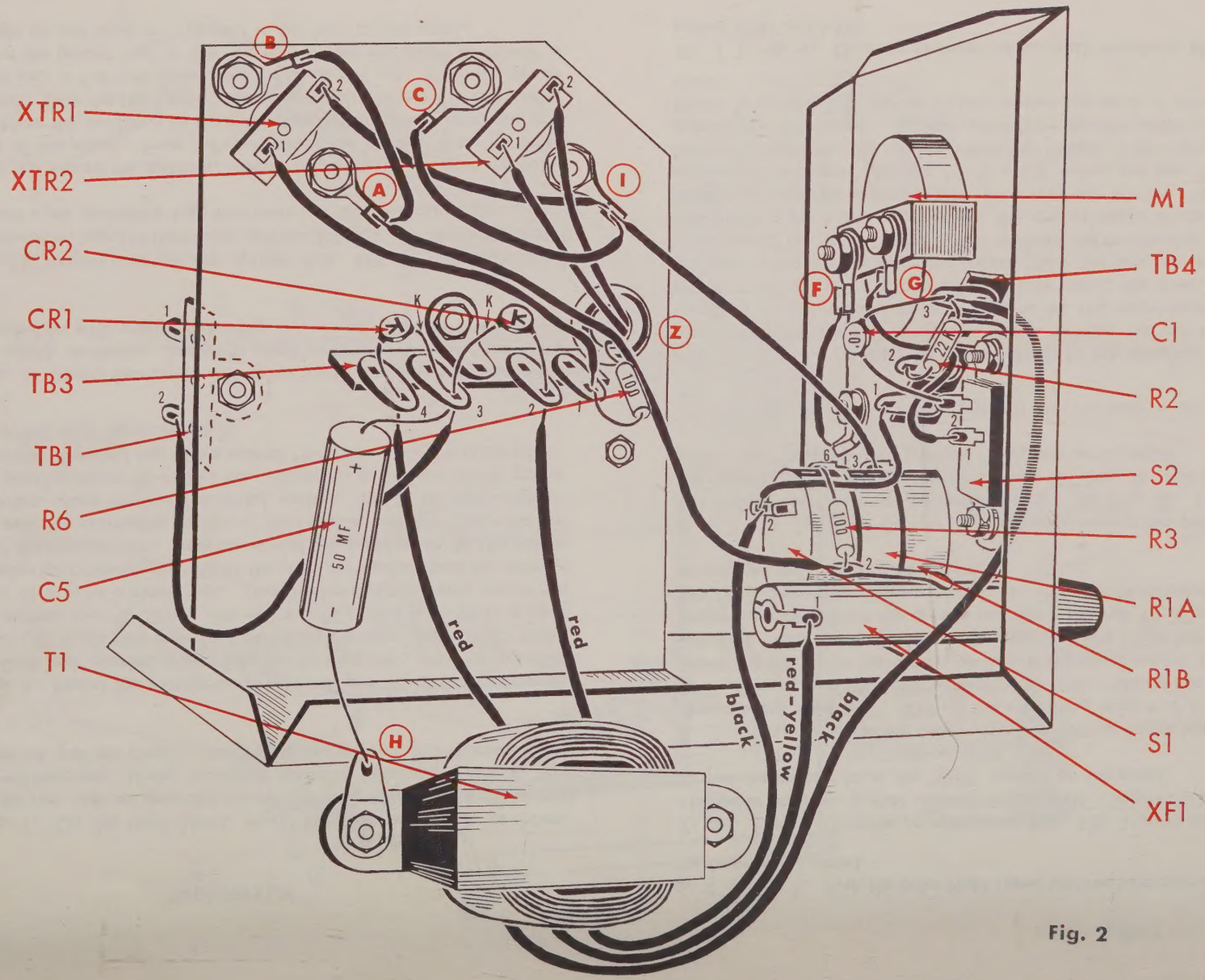

XTR1
XTR2
CR2
CR1
TB3
TB1
R6
C5
T1
M1
TB4
C1
R2
S2
R3
R1A
R1B
S1
XF1
B
C
A
I
F
G
Z
H
K
K
50 MF
+
-
10
100
22
red
red
black
red-yellow
black

Fig. 2

WIRING PROCEDURE

The transistor and silicon rectifier are rugged components, when handled properly. Handled carelessly they can easily be damaged. Do not manhandle the transistor or rectifier. Never solder to the leads, unless proper precautions are taken to conduct heat away from the lead, such as holding the lead between the soldering iron and the transistor or rectifier with a pair of long nose pliers. Keep heat away from the transistor and rectifier. Do not pull or twist the transistor leads. In any of the following steps, never solder to the transistors or to the socket when mounted to the transistor.

1. ( ) Fig. 2. From power transformer T1, connect one red lead to TB3-4 (C) and the second red lead to TB3-2 (C). Connect the shorter black lead to S1-1 (C) and the longer black lead to TB4-3 (C). Connect the red-yellow lead to XF1-1 (C).

2. ( ) Fig. 2. Connect a 5" piece of blue wire from TB3-3 (C) to TB1-2 (C). This wire is oversized to allow for the necessary slack.

3. ( ) Fig. 2. On the 50 mfd, 50 volt electrolytic capacitor, C5, cut both leads to 1". Connect the positive (+) lead to TB3-3 (C) and the negative (-) lead to ground lug "H" (S1).

4. ( ) Fig. 2. Connect a 2" piece of red wire from lug "A" (C) to lug "B" (S1).

5. ( )) Fig. 2. Remove the transistor socket XTR-1 from the transistor. On one lug, on the socket, solder a 3" piece of blue wire and on the second lug, solder a 3 1/2" piece of red wire. Remount the socket on transistor TR-1, with the red lead furthest away from the meter. Connect the other end of the blue lead to "I" (C) and the other end of the red lead to TB3-1 (C).

6. ( ) Fig. 2. Connect a 2 1/2" piece of red wire from lug "I" (C) to lug "C" (S1).

7. ( ) Fig. 2. Remove the transistor socket XTR-2 from the transistor. On one lug, on the socket, solder a 3" piece of red wire and on the second lug, solder a 3 1/2" piece of blue wire. Remount the socket on transistor TR-2, with the red lead closest to transistor TR1. Push the other end of the two wires through the grommet in hole "Z".

8. ( ) Fig. 2. Connect a 4" piece of blue wire from lug "I" (S3) to R1B-3 (S1).

9. ( ) Fig. 2. We are supplied with silicon rectifiers by several different reliable manufacturers, for use with this kit. The rectifiers, as supplied by one manufacturer, are discs with radial leads. Printed on the face of each of these rectifiers is an arrow pointing to and touching a flat bar. The bar is near the cathode (K) lead.

Other manufacturers supply us disc shaped rectifiers with axial leads. These rectifiers have a metal disc on one surface and a plastic coating over the second side. The surface with the metal disc is the cathode (K) side.

Your kit contains two of these fine rectifiers of either construction. On CR1, connect the cathode (K) lead to TB3-3 (C) and connect the remaining lead to TB3-4 (S2). On CRA, connect the cathode (K) lead to TB3-3 (S4). Connect the remaining lead on CR2 to TB3-2 (S2).

10. ( ) Fig. 2. Connect a 6 1/2" piece of yellow wire from lug "A" (S2) to XF1-2 (C). Run the lead along the chassis, as shown.

11. ( ) Fig. 2. Cut one lead on a 100 ohm (brown, black, brown, silver) resistor, R6, to 3/4" and the second lead to 1-1/4". Connect the shorter lead to TB3-1 (S2). Push the other lead through the grommet in hole "Z". Do not push the body of the resistor through the grommet.

12. ( ) Fig. 2. Cut both leads on a 22K (red, red, orange, silver) resistor, R2, to 5/8". Connect from TB4-2 (C) to TB4-3 (C).

13. ( ) Fig. 2. Cut both leads on a .01 mfd (10K or 10,000 mmf) disc capacitor C1, to 1/2". Connect from TB4-3 (C) to S2-2 (C).

14. ( ) Fig. 2. Cut both leads on a 100 ohm (brown, black, brown, silver) resistor, R3, to 1". Cover one lead with a 3/4" piece of spaghetti and connect it to R1A-6 (S1). Connect the second lead to XF1-2 (S2).

15. ( ) Fig. 2. Connect a 2 1/4" piece of blue wire from S1-1 (S2) to TB4-1 (C).

16. ( ) Fig. 2. Connect a 2" piece of blue wire from S2-1 (S1) to lug "G" on meter M1 (C).

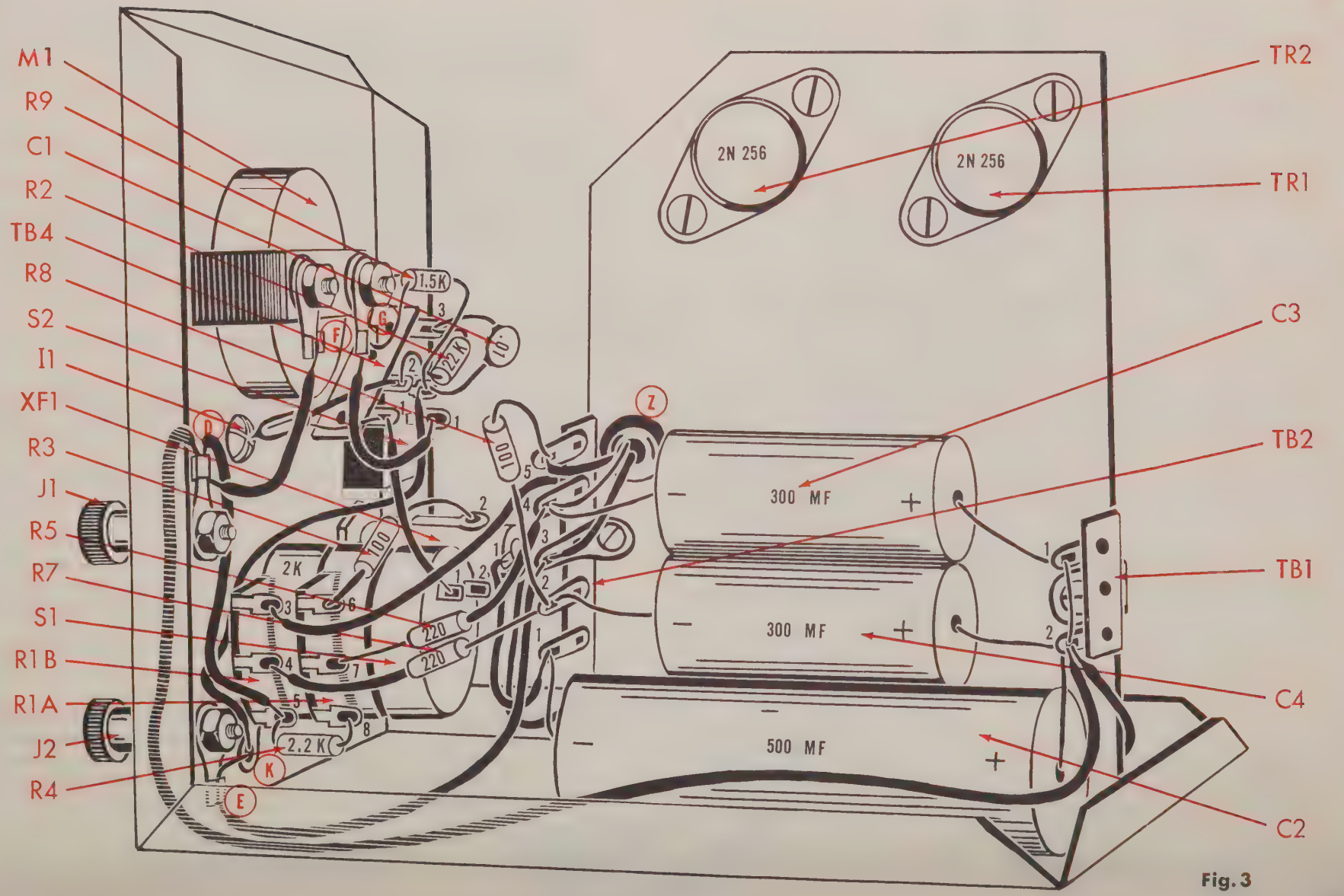

M1
R9
C1
R2
TB4
R8
S2
I1
XF1
R3
J1
R5
R7
S1
R1B
R1A
J2
R4
TR2
TR1
C3
TB2
TB1
C4
C2
2N 256
2N 256
300 MF
300 MF
500 MF
1.5K
22K
10
100
2K
220
220
2.2K
Z
F
G
K
E

Fig. 3

WIRING CONT'D.

1. ( ) Fig. 3. On the neon bulb, I1, cut one lead to 1/2" and the second lead to 3/4". Connect the shorter lead to TB4-1 (S2). Cover the longer lead with a 1/2" piece of spaghetti and connect to TB4-2 (S2). Orient this bulb so that it is against the panel, opposite the jewel.

2. ( ) Fig. 3. Connect a 4 1/2" piece of blue wire from S2-2 (C) to pot lug "K" (C).

3. ( ) Fig. 3. Cut both leads on the 1.5K, 1% resistor, R9, to 3/4". Connect it from lug "G" (S2) on meter M1 to S2-2 (S3).

4. ( ) Fig. 3. Connect a 1 1/2" piece of yellow wire from lug "D" (C) to R1B-5 (C).

5. ( ) Fig. 3. Connect a 3" piece of yellow wire from lug "D" (C) to lug "F" (S1) on meter M1.

6. ( ) Fig. 3. Connect a 7 1/2" piece of yellow wire from lug "D" (S3) to TB1-2 (C).

7. ( ) Fig. 3. Connect a 1" piece of bare wire from lug "K" (S2) to lug "E" (C).

8. ( ) Fig. 3. Connect a 4" piece of blue wire from lug "E" (S2) to TB2-3 (C).

9. ( ) Fig. 3. Cut both leads on a 2K (red, black, red, gold) resistor, R4, to 5/8". Connect from R1A-8 (S1) to R1B-5 (S2).

10. ( ) Fig. 3. Cut both leads on a 220 ohm (red, red, brown, silver) resistor, R5, to 1". Connect from R1A-7 (S1) to TB2-4 (C).

11. ( ) Fig. 3. Cut both leads on a 220 ohm (red, red, brown, silver) resistor, R7, to 1". Cover each lead with a 3/4" piece of spaghetti. Connect from R1B-4 (S1) to TB2-2 (C).

12. ( ) Fig. 3. From hole "Z" connect the red lead to TB2-5 (C), the blue lead to TB2-3 (S2) and the lead from the 100 ohm resistor R6 to TB2-4 (C).

13. ( ) Fig. 3. Cut both leads on the 500 mfd, 50 volt electrolytic capacitor, C2, to 1". Connect the positive (+) lead to TB1-2 (C) and the negative (-) lead to TB2-1 (C).

14. ( ) Fig. 3. Cut both leads on two 300 mfd, 25 volt electrolytic capacitors, C3 and C4, to 1 1/4". Use only required length of these leads to dress C3 & C4 neatly on top of each other. Cut excess wire. Connect the negative (-) lead of C4 to TB2-2 (C) and the positive (+) lead to TB1-2 (C). Connect the negative (-) lead of C3 to TB2-4 (S3) and the positive (+) lead to TB1-1 (C).

15. ( ) Fig. 3. Connect a 1 1/4" piece of bare wire from TB1-1 (S2) to TB1-2 (S5). Dress leads and terminal strip TB1, so that it will not short against the rear of the case when the unit is finally assembled.

16. ( ) Fig. 3. Cut both leads on a 100 ohm (brown, black, brown, silver) resistor, R8, to 1". Cover each lead with a 3/4" piece of spaghetti and connect from TB2-5 (S2) to TB2-2 (S3).

17. ( ) Fig. 3. Connect a 4" piece of yellow wire from TB2-1 (S2) to XF1-1 (S2).

FINAL ASSEMBLY AND TEST

1. ( ) Mount the handle in the two holes on the top of the cover. Use two #10-24 screws.

2. ( ) Push a rubber grommet into the 3/8 hole in the rear of the top cover. From the outside, push the tinned leads end of the line cord through the grommet. On the inside, tie a knot in the line cord 9" from the tinned end. Connect one tinned lead to S1-2 (S1) and the second tinned lead to TB4-3 (S4). See figure 2 for wiring.

3. ( ) Turn "VOLTAGE ADJUST" knob to "OFF" position.

4. ( ) Put slide switch into "30V" position.

5. ( ) Remove both transistor sockets from the two transistors letting them hang on their leads, in the air.

6. ( ) Using ohmmeter connect the negative (-) lead to the negative output jack J2 on your 1020 power supply. With the positive lead, measure the resistance to the body of both the transistor and all screws used for mounting both transistors. In all cases the resistance shall be 3-4KΩ. If resistance is too high - check wiring. If resistance is too low - check wiring for shorts. If resistance is zero or near zero, it is a good indication that transistor body, is shorted to the chassis. Check mica washers for damage.

7. ( ) Resistance between ground and both lugs on socket XTR1 should measure 2-4KΩ. Any large deviation from this value will indicate a wiring error.

8. ( ) Resistance between ground and lug 1 on socket XTR-2 should be 2-3K and between ground and lug 2 should be zero.

9. ( ) Connect the negative (-) lead of the ohmmeter to the negative (-) lead of C2. Connect the positive (+) lead of ohmmeter to the positive (+) lead of same condenser. Resistance should read more than 3KΩ after one minute time. A complete or a nearly dead short will indicate a wiring mistake or a shorted silicon rectifier.

10. ( ) Connect ohmmeter (+) and (-) leads to the (+) and (-) output jacks, J1 and J2, respectively. Resistance should read 1-2KΩ. Short or near short will indicate a wiring error or a shorted C5 capacitor.

11. ( ) After this unit passed all these checks put both transistor sockets back on transistor pins as indicated in steps 5 & 7 of figure 2 above.

12. ( ) Leave meter switch in "30V" position. Plug line cord into a 117V 60 cy. outlet. Turn the control clockwise until a switch click is heard. If you continue turning the control in the same direction there will be a voltage indication on the meter. When the voltage adjust control is turned fully clockwise, the meter will indicate more than 30 volts. If there is no voltage indication on the meter, re-check fuse continuity and wiring. Incidentally, a glowing pilot light is not an indication of fuse continuity. The fuse is in the secondary of the power transformer. After this check, switch the unit off.

13. ( ) For this final step a DC voltmeter with 50V scale should be used. (Preferably one with more than 5KΩ per volt). Connect the negative (-) lead of voltmeter to the insulated lug "A" Fig. 2. The positive (+) lead of voltmeter is to be connected to lug #2 on this transistor socket XTR1. Switch power supply to "ON". DO NOT advance the "voltage adjust" control. Voltage on the meter should read 20-26V. Switch power supply off.

In the same manner, check the second transistor socket, TR2. The (-) lead of the voltmeter must be connected to lug "C" and the (+) lead to lug #2 on XTR2. Switch power supply to "ON". Voltage on the meter should be 20-26V. If the voltages just measured are not within specified limits, check for wiring errors or a defective transistor. DO NOT operate power supply with voltages different from that specified above, or the transistor will be damaged. Incidentally, advancing of "voltage adjust" control clockwise will decrease the voltage drop across the transistors.

14. ( ) If your power supply passes all these tests, remove the plug from A.C. line. Mount the cover to the front panel and chassis assembly, so that the cover fits over the lips on the front panel and bottom. Secure the cover to the panel using eight #6 PK self tapping screws.

15. Refer for service information to the Instruction Book.

VOLTAGE CHART

MEASURED BETWEEN	DC VOLTS
Pt. A on schematic (neg. voltmeter lead) and XTR1-2 (pos. voltmeter lead)	20-26
Pt. C on schematic (neg. voltmeter lead) and XTR2-2 (pos. voltmeter lead)	20-26

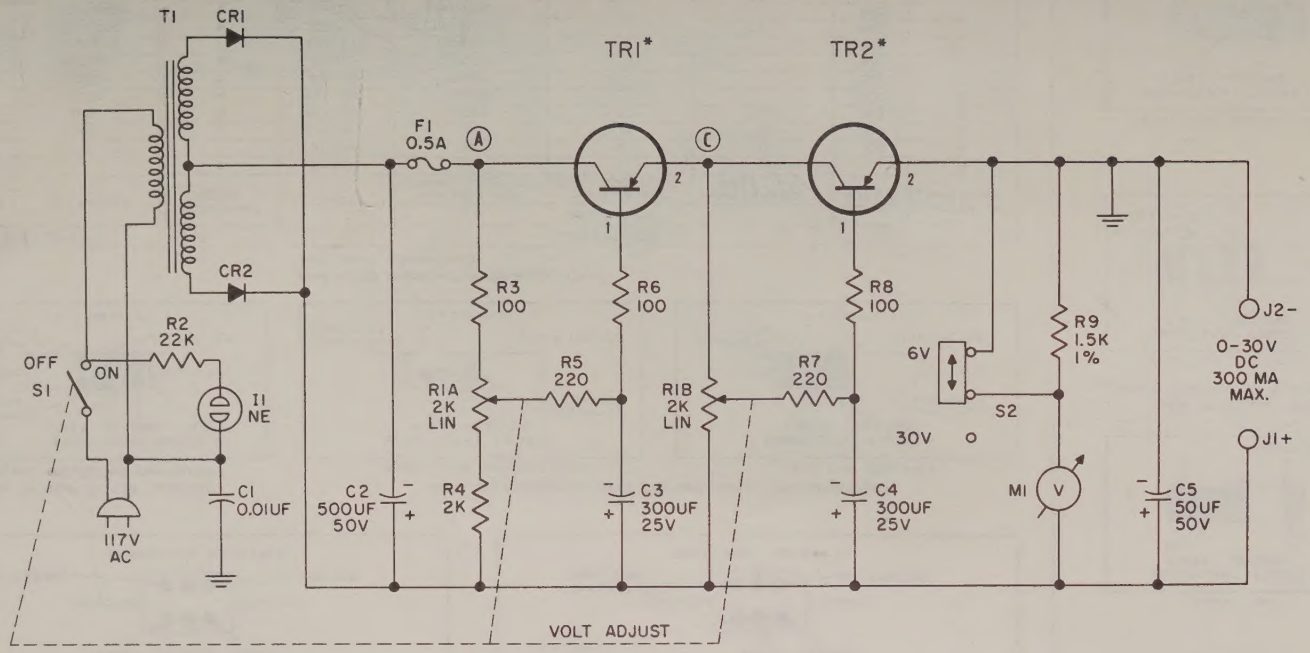
CONDITIONS OF MEASUREMENT: Voltage ADJUST control turned on, but left at the furthest counter-clockwise setting (advancing the VOLTAGE ADJUST control will decrease the voltages measured above). Slide switch set to 30V position. Power supply plugged into 117VAC line. Turn instrument off between measurements and during connection or disconnection of voltmeter leads. Voltmeter should be a VTVM or a VOM of at least 5000 ohms/volt. DO NOT operate the power supply unless the voltages measured above are within the prescribed range.

TROUBLE-SHOOTING CHART

Symptom	Cause	Remedy
Pilot light does not light	Lead broken	Resolder
	Line cord on plug open	Replace
Pilot light on, but no meter indication	Open fuse	Replace
	Defective meter	Replace
	Open power transformer	Replace
	Defective transistor	Test and replace
Voltage can not be adjusted to zero	Body of transistor shorted to chassis	Check mica washer between transistor and chassis
	Shorted transistor	Test and replace
Meter does not read on 6V range	Open meter	Replace
	Open 1.5K resistor, K9	Replace
Voltage can not be adjusted to 30 volts	Low capacity at C2	Replace
	Defective CR1 or CR2	Replace
	Defective dual pot	Replace
	Defective transistor	Test and replace
Tunable cross-modulation in application	Defective C1	Replace
	Plug inserted in wrong direction in AC line outlet	Reverse plug in AC line outlet

REPLACEMENT PARTS LIST

Stock #	Symbol	Description	Am't.
22519	C1	cap., disc, .01mfd ±10% (10k or 10,000)	1
23026	C2	cap., elec., 500mfd, 50V	1
23017	C3, 4	cap., elec., 300mfd, 25V	2
23011	C5	cap., elec., 50mfd, 50V	1
93005	CR1, 2	rectifier, silicon, 200 ma.	2
91007	F1	fuse, .5A	1
92008	I1	bulb, NE-2H	1
52002	J1	binding post, red (PLUS)	1
52001	J2	binding post, black (MINUS)	1
74007	M1	meter	1
18056	R1A, 1B	pot., dual 2KΩ with switch	1
10018	R2	res., 22KΩ, 1/2W, ±20%	1
10439	R3, 6, 8	res., 100Ω, 1/2W, ±10%	3
10532	R4	res., 2KΩ, 1/2W, ±5% %	1
10004	R5, 7	res., 220Ω, 1/2W, ±20%	2
11068	R9	res., 1.5KΩ, 1/2W, ±1%	1
	S1	switch, SPST on R1	1
62001	S2	switch, slide SPST	1
30032	T1	transformer, power	1
54003	TB1	term. strip, 2 post	1
54018	TB2	term. strip, 4 post w/gnd.	1
54008	TB3	term. strip, 4 post	1
54014	TB4	term. strip, 3 post, 2 left	1
94004	TR1, 2	transistor, 2N307 or equivalent	2
97800	XF1	fuseholder	1
97045	XTR1, 2	socket, transistor	2
40000		nut hex, #6-32	9
40007		nut hex, #4-40	2
40008		nut hex, #8-32	4
40012		nut hex, #10-32	2
40016		nut hex, 1/2-24 (for fuseholder)	1
40018		nut hex, 3/8-32	1
41000		screw, #6-32 x 1/4	5
41006		screw, #10-24	2
41014		screw, #6-32 x 3/8	4
41016		screw, #4-40 x 1/4	2
41035		screw, #6 PK	8
42000		washer, 3/8 lock	1
42001		washer, 3/8 flat	1
42002		washer, #6 lock	4
42004		washer, #10 lock	2
42006		washer, #6 fibre shoulder	4
42011		washer, #10 flat	2
42029		washer, rubber for fuseholder	1
42043		washer, bakelite shoulder	2
42044		washer, bakelite flat	2
42046		washer, #8 flat metal	2
42048		washer, mica for transistor	2
43000		lug, #6	1
43001		lug, 3/8 flat	1
43002		lug, #10	2
43004		lug, #8	6
46000		grommet, 3/8	2
53027		knob	1
57000		line cord	1
58004		wire hookup	length
58300		spaghetti	length
58501		wire, bare	length
81176		front panel	1
81177		cover	1
81910		chassis	1
87000		handle	1
97710		jewel, red	1
66075		Manual of Instruction (Wired)	1
66324		Manual of Instruction (Kit)	1

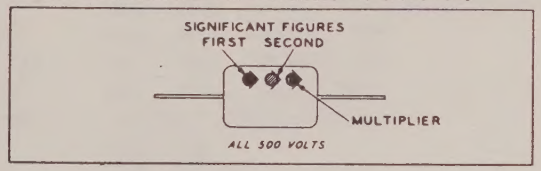


Ⓐ, Ⓒ ARE TEST POINTS

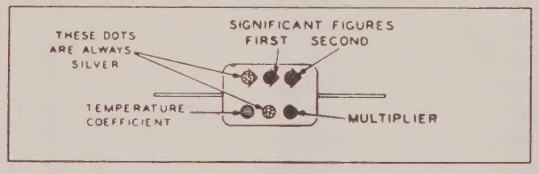
*TR1, TR2: TYPE 2N307 OR EQUIVALENT.

CAPACITOR COLOR CODES

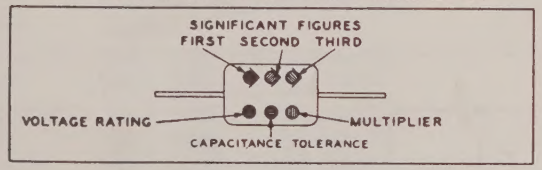
RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



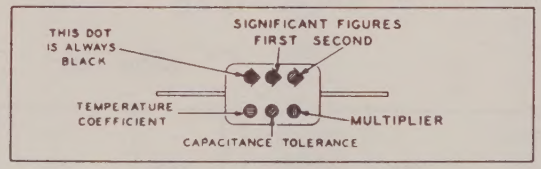
JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



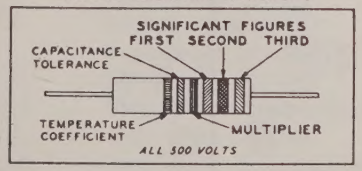
RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

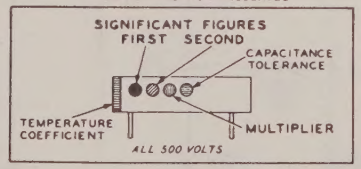


RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS

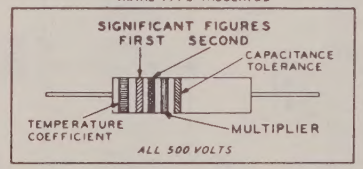


JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS

RADIAL TYPE NON-INSULATED



AXIAL TYPE INSULATED



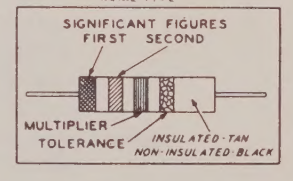
RMA: RADIO MANUFACTURERS ASSOCIATION
JAN: JOINT ARMY-NAVY

RESISTORS				CAPACITORS				
				MULTIPLIER				
TOLERANCE	MULTIPLIER	SIGNIFICANT FIGURE	COLOR	RMA MICA AND CERAMIC-DIELECTRIC	JAN MICA AND PAPER-DIELECTRIC	JAN CERAMIC DIELECTRIC	VOLTAGE RATING	TEMPERATURE COEFFICIENT
	1	0	BLACK	1	1	1		A
	10	1	BROWN	10	10	10	100	B
	100	2	RED	100	100	100	200	C
	1,000	3	ORANGE	1,000	1000	1000	300	D
	10,000	4	YELLOW	10,000			400	E
	100,000	5	GREEN	100,000			500	F
	1,000,000	6	BLUE	1,000,000			600	G
	10,000,000	7	VIOLET	10,000,000			700	
	100,000,000	8	GRAY	100,000,000		0.01	800	
	1,000,000,000	9	WHITE	1,000,000,000		0.1	900	
5	0.1		GOLD	0.1	0.1		1000	
10	0.01		SILVER	0.01	0.01		2000	
20			NO COLOR				500	

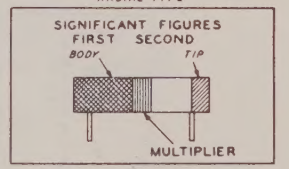
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE

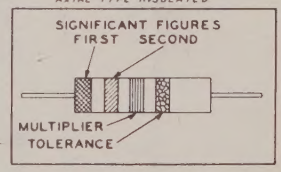


RADIAL TYPE

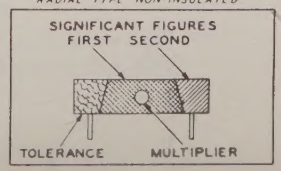


JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE INSULATED



RADIAL TYPE NON-INSULATED



www.manualsplus.com
1028645

EICO

ANOTHER PERFORMANCE PROVEN PRODUCT

SE Laboratories
LOC. EE4
MAN – 05992